

WHAT IS CLAIMED IS:

- 1 1. An antenna array system, comprising:
2 a plurality of antenna elements organized in an array and configured to form a
3 non-planar shaped antenna array surface; and
4 switching circuitry configured to switch each of the plurality of antenna
5 elements on or off based on control signals;
6 wherein the antenna beam direction can be steered in a first direction by
7 switching on a first set of antenna elements, and wherein the antenna beam direction can be
8 steered in a second direction by switching on a second set of antenna elements.
- 1 2. The antenna array system as recited in claim 1, wherein the antenna
2 beam direction can be steered in a plurality of directions by switching on a set of antenna
3 elements for each of the plurality of directions.
- 1 3. The antenna array system as recited in claim 1, wherein the horn
2 elements are selected from the group consisting of cylindrical horn antenna elements, conical
3 horn antenna elements, step-cylinder horn antenna elements, dipole antenna elements, helical
4 antenna elements and slot antenna elements.
- 1 4. The antenna array system as recited in claim 1, wherein the antenna
2 elements are symmetrically located within the antenna array.
- 1 5. The antenna array system as recited in claim 1, wherein the antenna
2 elements evenly spaced within the antenna array.
- 1 6. The antenna array system as recited in claim 1, wherein the antenna
2 elements are the same size.
- 1 7. The antenna array system as recited in claim 1, wherein the non-planar
2 shaped antenna array surface comprises a non-planar shape selected from the group
3 consisting of a spherical convex shape, a spherical concave shape, a parabolic convex shape,
4 a parabolic concave shape, an ellipsoidal convex shape, an ellipsoidal concave shape, a
5 saddle shape, or an airfoil shape.

1 8. The antenna array system as recited in claim 1, wherein the antenna
2 array is a transmit antenna array, a receive antenna array, or a transmit and receive antenna
3 array.

1 9. The antenna array system as recited in claim 1, wherein the antenna
2 array comprises M-number of antenna elements, and wherein the switching circuitry is
3 configured to control N-number of the M-number of antenna elements at a given time, the
4 switching circuit comprising:

5 a signal splitter adapted to split a signal into N-number of signals;
6 a switching matrix comprising NxM-number of switches; and
7 switch control circuitry adapted to control the switching matrix so that a
8 specified set of the N-number of the M-number of antenna elements are switched on.

1 10. The antenna array system as recited in claim 9, wherein the switching
2 matrix comprises MEMS switches.

1 11. The antenna array system as recited in claim 9, wherein the switching
2 circuit further comprises a signal amplifier adapted to amplify the signal prior to the signal
3 entering the signal splitter.

1 12. The antenna array system as recited in claim 9, wherein the switching
2 circuit further comprises a filter/diplexer adapted to separate transmit and receive signals
3 to/from the antenna array.

1 13. The antenna array system as recited in claim 1, wherein the antenna
2 array system is adapted for use on ground stations, air vehicles, water vehicles , ground
3 vehicles or space vehicles.

1 14. The antenna array system as recited in claim 1, wherein the antenna
2 array comprises a hexagonal array of antenna elements.

1 15. The antenna array system as recited in claim 14, wherein the hexagonal
2 array comprises a plurality of hexagonal antenna element clusters abutted together to form
3 the hexagonal array, each hexagonal antenna element cluster comprising X-number of
4 antenna elements configured in a hexagonal arrangement.

1 16. The antenna array system as recited in claim 15, wherein the antenna
2 array comprises N-number of the hexagonal antenna element clusters, and wherein the
3 switching circuitry is configured to control X-number of antenna elements at a given time,
4 the switching circuit comprising:

5 a signal splitter adapted to split a signal into X-number of signals;
6 a switching matrix comprising X-number of 1xN switches; and
7 switch control circuitry adapted to control the switching matrix so that a
8 contiguous set of the X-number of the antenna elements are enabled.

1 17. The antenna array system as recited in claim 16, wherein the 1xN
2 switches comprise multiplexers.

1 18. The antenna array system as recited in claim 16, wherein the antenna
2 array comprises a total of M-number of antenna elements, and wherein the 1xN switches
3 comprise M-number of on/off switches.

1 19. A spacecraft, comprising:
2 an antenna array system, comprising:
3 a plurality of antenna elements organized in an array and configured to
4 form a non-planar shaped antenna array surface; and
5 switching circuitry configured to switch each of the plurality of
6 antenna elements on or off based on control signals;
7 wherein the antenna beam direction can be steered in a first direction
8 by switching on a first set of antenna elements, and wherein the antenna beam
9 direction can be steered in a second direction by switching on a second set of antenna
10 elements.

1 20. The spacecraft as recited in claim 19, wherein the antenna beam
2 direction can be steered in a plurality of directions by switching on a set of antenna elements
3 for each of the plurality of directions.

1 21. The spacecraft as recited in claim 19, wherein the horn elements are
2 selected from the group consisting of cylindrical horn antenna elements, conical horn antenna
3 elements, step-cylinder horn antenna elements, dipole antenna elements, helical antenna
4 elements and slot antenna elements.

- 1 22. The spacecraft as recited in claim 19, wherein the antenna elements are
2 symmetrically located within the antenna array.
- 1 23. The spacecraft as recited in claim 19, wherein the antenna elements
2 evenly spaced within the antenna array.
- 1 24. The spacecraft as recited in claim 19, wherein the antenna elements are
2 the same size.
- 1 25. The spacecraft as recited in claim 19, wherein the non-planar shaped
2 antenna array surface comprises a non-planar shape selected from the group consisting of a
3 spherical convex shape, a spherical concave shape, a parabolic convex shape, a parabolic
4 concave shape, an ellipsoidal convex shape, an ellipsoidal concave shape, a saddle shape, or
5 an airfoil shape.
- 1 26. The spacecraft as recited in claim 19, wherein the antenna array is a
2 transmit antenna array, a receive antenna array, or a transmit and receive antenna array.
- 1 27. The spacecraft as recited in claim 19, wherein the antenna array
2 comprises M-number of antenna elements, and wherein the switching circuitry is configured
3 to control N-number of the M-number of antenna elements at a given time, the switching
4 circuit comprising:
5 a signal splitter adapted to split a signal into N-number of signals;
6 a switching matrix comprising NxM-number of switches; and
7 switch control circuitry adapted to control the switching matrix so that a
8 specified set of the N-number of the M-number of antenna elements are switched on.
- 1 28. The spacecraft as recited in claim 27, wherein the switching matrix
2 comprises MEMS switches.
- 1 29. The spacecraft as recited in claim 27, wherein the switching circuit
2 further comprises a signal amplifier.
- 1 30. The spacecraft as recited in claim 27, wherein the switching circuit
2 further comprises a filter/diplexer adapted to separate transmit and receive signals to/from the
3 antenna array.

1 31. The spacecraft as recited in claim 19, wherein the antenna array
2 comprises a hexagonal array of antenna elements.

1 32. The spacecraft as recited in claim 31, wherein the hexagonal array
2 comprises a plurality of hexagonal antenna element clusters abutted together to form the
3 hexagonal array, each hexagonal antenna element cluster comprising X-number of antenna
4 elements configured in a hexagonal arrangement.

1 33. The spacecraft as recited in claim 32, wherein the antenna array
2 comprises N-number of the hexagonal antenna element clusters, and wherein the switching
3 circuitry is configured to control X-number of antenna elements at a given time, the
4 switching circuit comprising:
5 a signal splitter adapted to split a signal into X-number of signals;
6 a switching matrix comprising X-number of 1xN switches; and
7 switch control circuitry adapted to control the switching matrix so that a
8 contiguous set of the X-number of the antenna elements are enabled.

1 34. The spacecraft as recited in claim 33, wherein the 1xN switches
2 comprise multiplexers.

1 35. The spacecraft as recited in claim 33, wherein the antenna array
2 comprises a total of M-number of antenna elements, and wherein the 1xN switches comprise
3 M-number of on/off switches.